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THE ECONOMY AND SOCIAL IMPLICATIONS OF AUTOMATION AND RAPIDLY CHANGING TECHNOLOGY OF AMERICA'S BLUE-COLLAR LABOR FORCE

by

Donald Norman Nopper

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BY

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Bachelor of Philosophy

University of Detroit, 1959

A Thesis Submitted to the School of Government and Business Administration of The George Washington University in Partial Fulfillment of the Requirements for the Degree of Master of Business Administration

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PREFACE

In the early months of 1961, President John F. Kennedy charged a select and distinguished group of American leaders of labor, management, and government with the task of recommending to him policies that should be followed by their respective interests for dealing with the major economic problems of the times. Specifically mentioned as a matter of paramount importance were the issues created by automation.

While the search for ways to replace human energy with mechanical or other forms has been pursued for centuries, the current phase has been most relentless and productive. One can witness and marvel at the speed, accuracy, and capability of industry's modern automated machines and, on the same visit and in the same locality, one can view with disdain and sympathy the plight of the workers displaced by the mechanical giants.

The impact of the trend toward automation is being felt by every industry and occupation. In its advent, automation promises unprecedented productivity and ever-rising standards of living, but in its wake are often the underemployed or unemployed. Automation has made many things possible for many Americans and yet, for too many other Americans, it can at best be described as a horribly inflated price of progress.

The intent of this paper is thus to describe and analyze the social and economic implications of automation which the semi-skilled and unskilled labor force of today and tomorrow must face. These implications may be subtle or blatant, emotionally charged or calmly accepted, and may involve legal, moral, and ethical considerations. The enormity and complexity of the problem is acknowledged by all, but the answers and solutions proposed are diverse, equally complex, and decidedly factional in acceptance.

In order to accomplish this goal, the author has chosen to sub-divide this paper into two major chapters which veridically and concisely treat the important issues. These major issues are preceeded by a comprehensive introduction and an appropriate finale. It is to be noted that the stated purpose is neither to provide a comprehensive history of automation nor a detailed examination of automated hardware.

In Chapter I, an appropriate background for understanding the automation problem is presented. Included in this introduction are useful definitions, a brief history of the subject, and an overview of the current trend toward automation.

Chapter II addresses itself to the economic implications of automation and evaluates these in terms of their effect on employment, productivity, and new products.

In Chapter III the social implications of rapid technological change is described and analyzed.

Chapter IV is a summation of the total problem and provides the author's personal observations and conclusions regarding what should be done, by whom, and when, in order to maximize the benefits and minimize the distresses associated with automation.

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CHAPTER I

INTRODUCTION

In this opening chapter three elements essential to the study of the current and controversial problem of automation are presented. These elements are: first, an appropriate definition of automation; second, a brief review of the historical development leading to our current industrial technology; and third, an overview of the present trend toward automation.

Automation and Technological Progress Defined

While there is general conceptual agreement among authors as to the definition of automation, writers often will emphasize one factor or another within their definitions depending on their occupational-oriented background. Thus for example, an engineer might define the concept in terms of "continuous automatic production, largely in the sense of linking together already highly mechanized individual operations. . . . a way of work based on the concept of production as a continuous flow, ..." [1] An educator, on the other hand, may propose a more general definition and describe it simply as:

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[1] U.S., Department of Labor, Bureau of Labor Statistics, An Inquiry Into the Effects of Automation, by Edgar Weinberg, Monthly Labor Review (Washington, D.C.: Government Printing Office, January, 1956), p. 1.

"the relegation to a machine of the function of performing operations previously performed manually." [1] Dr. Walter Buckingham, an economist and college president, defines automation in terms of its four major principles--mechanization, feedback, continuous process and rationalization. Thus, his definition relates: "any continuous and integrated operation of a rationalized production system which uses electronic or other equipment to regulate and coordinate the quantity and quality of production." [2] Buckingham's definition is perhaps the most useful for most discussions of automation because it embodies the feedback principle. Feedback is an important aspect of automation and is best explained as a concept of control whereby the machine's own output governs or regulates the machine's input to ensure a predetermined standard of performance. [3] This concept of control through communications has another equally significant value: the basis for industrial applications of Cybernetics. [4]

As will be shown in subsequent chapters, the definitions given may adequately describe what is meant by "automation,"

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[1] Ibid., pp. 1-2.

[2] Walter S. Buckingham, "The Four Major Principles," in Machines and the Man--A Sourcebook on Automation, ed. by Robert P. Weeks (New York: Appleton-Century-Crafts, Inc., 1961), pp. 36-37.

[3] Ibid., p. 36.

[4] Cybernetics is the term coined by the late Dr. Norbert Wiener for his studies of the functions of the human brain as compared with the functions of a complex mechanical/electronic machine. The term is often used synonymously with automation.

but these definitions are nonetheless quite incomplete and unsatisfactory for discussions concerning the serious implications which arise from the reality itself.

John Diebold, who is credited with coining the word "automation," has the following to say regarding the controversy over the term: [1]

> . . . I meant it [automation] to describe an exciting new system of making factory assembly lines almost completely automatic through the use of electronic control systems. The concept has since been broadened to embrace a whole new method of using technical knowledge, and most of its applications are outside the factory. It enables man to undertake tasks which hitherto have been impossible, to extend his capabilities beyond all previous limits, and to create a multitude of new industries. Naturally I am pained and somewhat astonished that automation is so widely misunderstood and feared. [2]

One such problem that often arises is the distinction that must be made between the terms "automation" and "mechanization." Whereas automation involves a machine to do the work and a second machine to direct and control it, mechanization refers only to the substitution of human labor by machines. Thus in mechanization a man thinks for a machine; in automation machines "think" for machines.

The distinction between automation and mechanization is important because automation is too often viewed as merely technological development. That automation includes, but

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[1]The word itself is said to have been coined simultaneously but independently by John Diebold, then a student at the Harvard Graduate School of Business Administration and later editor of Automatic Control, and Mr. Delmar S. Harder, vice-president of the Ford Motor Company.

[2]John Diebold, "Facing Up to Automation," The Saturday Evening Post, September 22, 1962. (Reprinted by the Diebold Group, Inc.)

nonetheless transcends, this mere labor-substitution viewpoint is best explained by John Diebold when he submits:

> Automation is more than a series of new machines and more basic than any particular hardware. It is a way of thinking as much as it is a way of doing. It is a new way of organizing and analyzing production, a concern with the production processes as a system, and a consideration of each element as part of the system. It is something of a conceptual break-through, as revolutionary in its way as Henry Ford's concept of the assembly line. Indeed, it may in the end have an even more widespread effect on business and industry, since it's technology rests on a firm theoretical foundation rather than on a specific method of organization or particular kind of machine. [1]

A noted labor leader has also recognized the encompassing impact of automation and has stated:

> . . . the new industrial technology being called automation is the strongest single force in the American society today or in any society that is industrializing . . . . . it is a force stronger than any of the traditional forces in our society except one, and that is education itself.
>
> I am interested on this point that the eminent British historian Toynbee speaks about the impact of technology on American society. It produces for us the necessity to quote his words, 'to find a compromise between two essentially American things, extreme individualism and extreme mechanization.' But much more is involved in automation than merely mechanization. 'America's future,' Toynbee continues, 'will depend largely on how she reconciles these contradictory tendencies.' [2]

Perhaps the best appreciation for the concept of automation can be gained by viewing it as analogous to a

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[1] John Diebold, "Bringing Automation Up to Date," in Automation--Implications for the Future, ed. by Morris Philipson (New York: Random House, Inc., 1962), p. 26.

[2] Ted F. Silvey, "Effects of Automation," (reprint of an address presented at the Conference of the Great Lakes Association of Railroad and Utilities Commissioners; White Sulphur Springs, W. Va., July 8, 1965), p. 1.

three-legged stool. This analogy, as conceived by a noted labor official, describes automation as an extension, or in many ways, a replacement for three human faculties: a highly engineered mechanization which extends or replaces physical strength and manual dexterity; an instrumented or automatically controlled device which extends or replaces human perceptive senses and reactions; and an electronic computer which extends or replaces the human memory or capacity for simple repetitive decision making. [1] Figure 1 similarly presents this classification of mechanical technology in terms of a hierarchy of machines.

In view of the confusion which appears to surround the meaning of the term automation, it is considered essential that the definition as used in this paper be firmly established. Thus, automation as used in this thesis refers to the automatic centralized control of integrated control systems. [2] The differences that exist between more or less automated systems is not of particular relevance for the author's stated purpose.

Historical Development of Automation

Most authorities on the subject of automation agree that the current developments in industrial automation have resulted primarily from improvements which have occurred in

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[1]Ted F. Silvey, "Automation: The Three-legged Stool," Cybernetics Magazine, November 3, 1963, p. 133.

[2]William A. Faunce, Problems of an Industrial Society (New York: McGraw-Hill Book Co., Inc., 1968), p. 44.

HIERARCHY OF MACHINES

CLASS	DEGREE	CHARACTERISTICS	EXAMPLES
Mechanized	Slightly	Mechanical advantage	Auto jack
	Moderately	Mechanical advantage and patterned information	Printing press
	Highly	No overall program; one operation triggers the next	Automobile, Transfer machine
Automatic, self-operating and controlled	Semi-	Errors alert operator; has program but no feedback	Continuous flow petrochemicals plant
	Moderately	Must be set in motion but stops itself; may have feedback	Vending machine, Record changer
	Fully	Self-starting and stopping; has feedback	Headlight dimmer, Photocell device
Cybernetic	Functional	Self-adjusting to changing operating conditions	Automatic pilot
	Product oriented	Self-adjusts to changes in input or output	Translating machine, Product controlled ovens
	Sensitive to environment	Self-adjusts to external changes	Thermostat which regulates furnace according to outside weather

Fig. 1.--Hierarchy of machines. Source: Machines and the Man, p. 31.

the past six or seven decades. The discovery and harnessing of various sources of natural energy have however, formed the foundation for all modern technological progress. First and foremost in this development came the application of human and animal muscle power to perform work. This stage was closely followed by the utilization of hand tools and utensils and simple machines to be combined with human and animal strength to perform tasks that were beyond the ability of man or animal alone or that could be accomplished easier or more quickly with such devices.

From this primitive development men learned to control and apply such natural resources and phenomena as the wind, water, coal, petroleum, and electricity. As each new energy source was discovered and developed, more complex and effective machines were designed to utilize it. [1]

Various inventions throughout the history of mankind have most assuredly contributed to todays advanced technology. Included in this list of significant contributions are the water wheel, clock, steam engine, and various industrial and scientific mechanisms and processes affecting the textile and agricultural industries. [2]

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[1]Ted F. Silvey, "Automation and Community Planning," (reprint of an address presented at the 1955 Annual Planning Conference, American Society of Planning Officials and Community Planning Association of Canada, Montreal, Quebec, September 28, 1955), pp. 2-3.

[2]Phil E. Brookshire, "Automation and Technological Change as Viewed by Management, Labor and the Federal Government" (unpublished M.B.A. thesis, The George Washington University, 1965), pp. 3-6.

Oliver Evans, a Philadelphia flour mill operator, is credited with perhaps the first genuinely automated factory. In 1784 he designed and built a water powered flour mill wherein grain was fed into the mill by bucket conveyers, carried through various coarse and fine grinding operations, and eventually transformed into finished flour. [1]

In 1801, the first machine controlled by a punched card system was built in Paris by a weaver named Jacquard. This automatic loom provided the principle from which many contemporary machine designs evolved. [2]

Following Jacquard's automatic loom came Eli Whitney's cotton gin. In addition to the contributions that this machine made to the nineteenth century textile industry, Eli Whitney is also credited with developing the concept of the "interchangeable part." The latter contribution is far more significant than the gin because its introduction, in the early years of this century, to industrial production provided the impetus for modern mass production assembly lines. [3]

In addition to the various discoveries and inventions mentioned above, there are three situational factors in American history that have been instrumental in furthering the

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[1]National Association of Manufacturers, Calling All Jobs--An Introduction to the Automatic Machine Age (New York: National Association of Manufacturers, 1957), p. 12.

[2]Ibid.

[3]Ted F. Silvey, "Impact of Technological Change Upon Jobs and Labor Relations," (reprint of an address presented at Cornell University Conference, May 8-9, 1956), p. 1.

technological changes that characterize modern industry. The first of these three factors may be referred to as the practical and inventive spirit of Yankee ingenuity. The early settlers in America found themselves in a country enormously endowed with natural resources and thus capable of tremendous productivity and growth. Offsetting this richness however, was a critical shortage of manpower to utilize and benefit from it. As a result of this stringent limitation many labor-saving and thus cost-reducing devices were produced. [1]

A second major event or series of events which accelerated scientific investigation and technological development in this century were the two world wars. [2] These periods of national emergencies created immediate and absolute needs for increased productivity and more efficient utilization of scarce resources including manpower. Such requirements could only have been satisfied through responsive technological progress.

The third factor which encouraged the development of automation was and continues to be the desire of the American people for higher standards of living. It is a simple law of economics that a nation consumes what it produces, no more and no less. Man raises his standard of living by increasing his productivity and such increases are achieved mainly by improving his tools of production. Closely associated with increased

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[1] Silvey, "Effects of Automation," p. 2.

[2] Ibid., p. 3.

productivity are the benefits derived from the individual company or corporation maintaining its competitive status. In periods of rising labor and material costs, industries can continue to meet competition only by producing more per unit of labor or material input. [1] The huge DuPont Corporation summarizes this point in the following manner:

> In any free society, competition is the driving force behind almost all technological improvements; in an advanced industrialized society, automation has become one important and stimulating weapon in the competition for survival. DuPont believes it must automate wherever possible if it is to remain the leader in the American chemical industry. By the same token, American industry must seize upon every technological development if it is to continue to be an important factor in world markets. [2]

Recent Technological Trends

Automation techniques have taken on many new aspects and assignments in the past decade. The growing computer industry has been introduced in nearly every facet of our modern living. Automatic control processes gather and evaluate data, make decisions, generate and communicate instructions, monitor and guide processes, perform analyses and solve analytical problems; all accomplished at superhuman speeds and degrees of exactness. The following is a brief presentation of the nature of automated applications to industries and occupations.

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[1] Ralph W. Ells, Is Automation Causing Unemployment?, NAM Industrial Relations Sourcebook Series (New York: The National Association of Manufacturers), pp. 3-4.

[2] Automation and Employment, This Is DuPont Series, No. 27 (Wilmington, Delaware: E. I. DuPont De Nemours and Co., Inc., 1964), p. 15.

Electronic computers

The use of electronic computers has been steadily rising since their introduction during World War II and over 35,000 were in operation by 1967. Computers are being utilized by both private and public sectors of our economy for a variety of activities including routine data processing as well as specialized engineering and scientific purposes. Examples of current and exceptional applications include: the design and draft of new automobile models, intercompany airline reservation services, oil exploration recording and analysis, and the scheduling of large and complex construction operations. [1] The method by which modern oil refineries control their pipeline systems through which crude oil flows from Texas, guided by electronic impulses sent throughout the nation from a single computer center is another excellent example. [2]

Automated instrumentation and control

A second area of rapidly developing technology is the use of instrumentation and controls for sensing, measuring, accumulating data, and controlling temperature, flow, and other industrial processes. Such systems are being integrated with other already automated machines mainly in the paper, steel,

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[1]U.S., Department of Labor, Bureau of Labor Statistics, "The Many Faces of Technology," by Edgar Weinberg and Robert L. Ball, Occupational Outlook Quarterly, II No. 2, May, 1967 (Washington, D.C.: Government Printing Office, 1967), p. 1.

[2]Peter Drucker, "The Promise of Automation," in Automation--Implications for the Future, ed. by Morris Philipson (New York: Random House, Inc., 1962), p. 216.

chemical, cement, electric, petroleum and food processing industries. [1] Examples of this type of industrial application include:

> At McClouth Steel in Detroit and at Richard Thomas and Baldwins Spencer works in Llanwern, Wales, GE computers are used to monitor, control, regulate, and run a steel production line. Sensors feed measurements such as temperature, thickness, width, etc., into the computer, where they are compared with previously stored parameters. If the computer determines that any of these factors are out of line, the production unit is automatically regulated and a report is printed to management. In this way steel is produced almost without human intervention.
>
> A similar system is being used by the Mid-Hudson Power & Light Co. in Poughkeepsie, N.Y. to keep watch on generating equipment. The digital computer turns turbines on and off, watches for overloads and other dangerous conditions, and distributes power where it is needed. [2]

Machinery improvements

Newer, larger, more powerful machines are being designed, developed and integrated with automated equipment to effect greater productivity in many of the heavy industries such as railroad construction, highway and bridge construction, mining, steel fabricating, and major transportation facilities. [3] In some of the new aluminum forging plants, there are huge forging presses which can apply up to 50,000 tons of pressure. These huge forges are operated in conjunction with equally large dies

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[1]The U.S. Department of Labor, "The Many Faces of Technology," p. 2.

[2]Stanley L. Englebardt, "Computers Today," Science Digest Magazine, February, 1967, p. 7.

[3]The U.S. Department of Labor, "The Many Faces of Technology," p. 2.

and are used to fabricate airframe members. Members forged in this manner are stronger than if they had been formed using traditional methods. This particular operation would be impossible for men to do and great production performances like this can be done only with huge machinery and tremendous pressure. [1]

Numerical Control techniques

This technique is simply the use of tape and/or other automatic control devices to direct the operations of machines and machine systems. [2] Numerical Control applications include the aircraft, automobile and machine industries. The use of this innovation is particularly beneficial when very exact tolerances are required as in the missile or engine building industries. A California aircraft plant provides the best example of numerically controlled machines. On a particular skin milling machine, the skin of an aircraft wing is milled from three-quarters inch thick aluminum to fit the shape of the wing and to be of proper varying thickness. In such an operation, cutting tools must be controlled with precision and accuracy in order to complete the skin milling without errors that would scrap such a large and expensive job. It would be impossible for enough machinists operating hand cutting tools to vary the depth and indicate the direction of the tools.

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[1]Silvey, "Automation: The Three-legged Stool," p. 142.

[2]Diebold, "Bringing Automation Up to Date," p. 27.

There would also be the additional problem of the machinists communicating with each other and there would be human error. When the mathematical information is fed by proven directions and inanimately conveyed by punch cards or punched tape however, the work is carried out rapidly and free of errors. [1]

Summary

Automation is a relatively new word that has crept into our vocabulary and its meaning is subject to differing opinions. Perhaps the best way of viewing the concept is to think in terms of a three-legged stool: (1) highly engineered mechanization, (2) the feedback or closed loop control, and (3) the electronic computer. All of these capabilities are extensions or replacements for human faculties. Automation in a practical sense is a machine guided and controlled by an electronic brain through a media of tapes, punch cards, or other automatic devices such as thermostats, pressure gauges, etc.

The trend toward automation began early in the history of mankind and developed slowly as men advanced through various stages of pre-history, early history, middle ages, industrial revolution and into the twentieth century. Notable progress was achieved with the harnessing of water and windpower in

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[1]Silvey, "Automation: The Three-legged Stool," pp. 141-142.

the fifteenth and sixteenth centuries, the development of the steam engine in the early eighteenth century, the discovery and development of electricity in the nineteenth century, and the invention of the internal combustion engine in the twentieth century. The discoveries and inventions mentioned above along with many others have given rise to our modern technology. In addition to the development of various mechanisms and processes, there were at least three situational or environmental factors which are believed to have been instrumental in the evolution of automation: the American spirit and ingenuity in exploiting the rich natural resources of our nation despite a critical shortage of manpower, the successful prosecution of two world wars, and the desire of the American people to achieve and maintain higher standards of living through the maintenance of a free and competitive open-market economy.

In the past few decades automated techniques have taken on new dimensions and have been applied to nearly every industry and occupation. These techniques have been in the form of computer applications, automatic control processes, improved machinery and equipment, and automatically controlled machines and machine systems.

The following chapters will relate and discuss the social and economic implications that have evolved from the changing industrial technology described above.

CHAPTER II

ECONOMIC IMPLICATIONS OF AUTOMATION

While recognizing the difficulties inherent in attempts to differentiate between the aspects of automation which could be classified as economic versus those factors which are social in nature, it is intended that this chapter will be devoted to implications of automation that are decidedly or predominately of a financial nature (i.e., those having an effect on National Income figures). The three major economic implications for the blue-collar labor force have been determined as; (1) the effects of automation on employment, (2) the nature of the advantages derived from increased productivity resulting from the development and operation of automated machines and equipment, and (3) the new products which have evolved from technological advances. The impact of these factors will be described, analyzed, and evaluated in the remainder of this chapter.

Automation and Employment

The trend toward automation and our rapidly expanding technological progress has affected the national employment situation in two distinct ways: first, it has influenced the general levels of employment (and therefore unemployment); and second, it has resulted in formidable shifts in requirements for

occupational skills and technical knowledge. These two factors account for much of the recent strife in labor-management negotiations and are the subject of many heated debates by private and governmental economists concerned about the nation's economic growth and prosperity.

As examples of the grave concern over the employment aspects of automation, witness the following remarks by various labor, management, and government leaders:

> The ability of our economy to meet the needs of the men and women who make it up is to be measured primarily not by the degree of its technological progress--the variety of new and awe inspiring machines it can produce to take over human functions. The major measure of an economy's success must be the extent to which it utilizes the productive resources available to it, both physical and human, to meet human needs and to fulfill human aspirations. No amount of advanced technological equipment serves its purpose if it is not used--or if its use means only that men and women are left without the employment they want and need. (Walter Reuther, President, United Automobile, Aircraft, and Agricultural Implement Workers of America) [1]

> The ever-increasing gigantic powers of production of the modern industrial system, far exceeding those of any earlier experience in history, mean that an enormous output has to be reached before full employment is approached. Private industry and government together must act to maintain and increase output and income sufficiently to provide substantially full employment. (Alvin Hanses, professor of political economy, Harvard University) [2]

> Now there is nothing sacred, or even exact, about our finding that automation is causing the loss of jobs at the rate of nearly 40,000 a week.

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[1]Walter P. Reuther, "Automation and Energy Resources Joint Economic Sub-Committee Report," in Automation--Implications for the Future, ed. by Morris Philipson (New York: Random House, Inc., 1962), p. 270.

[2]Ibid., p. 275.

> What I do regard as sacred is the necessity for this country to face up to two hard and brutal truths. The first of these truths . . . is that automation is here to stay . . . . The second truth is that automation is putting a hell of a lot of people out of work this year [1963], and will continue to do so, increasingly, for a long time to come. (John I. Snyder, Jr., Chairman and President, U.S. Industries, Inc.) [1]

It is because of the fears and reservations expressed above that the following study of employment trends and policies is presented.

Automation and unemployment

The displacement of workers caused by technological advance is commonly referred to as "technological unemployment." The matter of technological unemployment through automation is so closely related to the matter of improved productivity through automation that it is difficult to discuss them separately. This section of the paper will however attempt to present the facts and figures of unemployment caused by automation and the later section on productivity will relate the figures as they affect wages, prices and national income.

In undertaking such a task it must be pointed out that there are few readily available studies and statistics which have specifically and unequivocally measured the effect of automation on unemployment. Despite this lack of precise data however, there is little doubt that technological change is

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[1]John I. Snyder, Jr., "The Total Challenge of Automation," (reprint of an address presented at the Fifth Constitutional Convention, AFL-CIO, New York City, N.Y., November 19, 1963), pp. 5-6.

responsible for an enormous volume of job displacement. The reasons for the difficulty in determining the exact impact of automation on unemployment are many (e.g., complications in gathering data due to a constantly increasing labor force, unemployment increases caused by decreased demand and hence curtailed production, impact of foreign imports into the U.S., and regional or industrial unemployment caused by technical advances or improved employment opportunities in other regions or industries).

The extent of technological unemployment is perhaps best reflected by the data contained in Figures 2 and 3 which show that in the key industries of mining, basic manufacturing, and basic processing, the impact of automation has been severe. In 1961, Time reported the following gloomy statistics:

> In the highly automated chemical industry, the number of production jobs has fallen 3% since 1956 while output has soared 27%. Though steel capacity has increased 20% since 1955, the number of men needed to operate the industry's plants--even at full capacity--has dropped 17,000. Auto employment slid from a peak of 746,000 in boom 1955 to 614,000 in November [1960] . . . . Bakery jobs have been in a steady decline from 174,000 in 1954 to 163,000 last year [1960]. [1]

In the event that the implications are not yet clearly appreciated, witness the following examples of automation in actual operation:

In 1952 Ford started operations in this plant [Ford

---

[1]"The Automation Jobless...Not Fired, Just Not Hired," Time, Vol. 77, No. 9, February 24, 1961, p. 69.

ITEM	1940	1950	1960	1963	1964	1965	1966
PRODUCTION: QUANTITY IN 000 SHORT TONS	460,772	516,311	415,512	458,928	486,998	512,088	533,881
AVERAGE NO. OF MEN EMPLOYED PER DAY	439,075	415,582	169,400	141,646	128,698	133,732	131,752
AVERAGE TONS PER MAN PER DAY	1,049	1,239	2,453	3,240	3,784	3,829	4,052

Fig. 2.--Bituminous coal--summary: 1940 to 1966. Source: The U.S. Book of Facts, Statistics, & Information For 1969, p. 674.

INDUSTRY GROUP	1958		1963		1966	
	EMPLOYEES (1000)	VALUE ADDED BY MANUFACTURE (MIL. DOL)	EMPLOYEES (1000)	VALUE ADDED	EMPLOYEES (1000)	VALUE ADDED
FOOD AND KINDRED PRODUCTS	1,718	17,701	1,643	21,826	1,642	24,896
TEXTILE MILL PRODUCTS	903	4,870	863	6,123	927	8,028
LUMBER AND WOOD PRODUCTS	585	3,213	563	4,021	570	4,789
PETROLEUM AND COAL PRODUCTS	179	2,518	153	3,713	141	4,737
LEATHER AND LEATHER PRODUCTS	349	1,898	327	2,079	341	2,481
PRIMARY METAL INDUSTRIES	1,092	11,642	1,127	15,261	1,297	20,908

Fig. 3.--Manufacturing general statistics, selected industries: 1958, 1963, and 1966. Source: The U.S. Book of Facts, Statistics, & Information For 1969, pp. 720-723.

> engine plant in Cleveland, Ohio] to machine automobile engine blocks with a battery of 71 machines linked together into an automatic line about 1600 feet long. Automated machine tools perform more than 500 boring, broaching, drilling, honing, milling, and tapping operations with little human assistance. The timing of each operation is synchronized so that the line moves forward uniformly. Shortly after this plant started operations it was estimated that 154 engine blocks an hour ran through the production line, requiring 41 workers. The same production pace, with older methods, required 117 men. [1]

and,

> The largest synthetic ammonia plant in the world, built in 1965 by the Olin-Mathieson Chemical Corporation, was designed to operate with a grand total of 32 employees, 11 of them supervisory, technical and clerical people. A steam-electric plant now in operation requires one lone worker per shift. [2]

There are two major opposing camps in the great debate over automation: one view is that of organized labor which emphasizes the short-run effects of displacement; the second, the opinion expressed by most industrial executives, is that in the long run, temporary displacements and surplus labor will be absorbed by the expansive effects of automation.

Mr. Walter Reuther's following remarks typlify the sentiment of the labor groups:

> Automation, in addition to the more conventional improvements in machines and work flow, will be increasing the rate of the national economy's rising man-hour output still further. Instead of average annual productivity increases of some 3 to 4 percent, the annual rate . . . may reach 5 to 6 percent or more . . . [a rate] capable of displacing about 3.5 million or more employees each

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[1] Labor Looks At Automation (Washington, D.C.: AFL-CIO, Publication No. 21, 1959), p. 7.

[2] Labor Looks At Automation (Washington, D.C.: AFL-CIO, Publication No. 21, 1966), p. 6.

> year, if the national economy fails to expand along with the rapid improvements in productive efficiency. [1]

Representing the optimistic viewpoints emphasizing the expansive effects of automation are the following public statements:

> I repeat, there is no reason to believe that this new phase of technology will result in overwhelming problems of readjustment. Science and invention are constantly opening up new areas of industrial expansion. While older and declining industries may show reducing opportunity, new and vibrant industries are pushing out our horizons. (U.S. Secretary of Labor, James P. Mitchell) [2]

and,

> . . . [there are] four factors at work to create new and increased employment opportunities. The "chain reaction" of economic growth (due to lower prices increasing the volume of business); the expanding service industries and increased time for educational and recreational activities; expansion of industries for designing, selling, building, and installing the new machinery, and the growth of entire new industries as a result of automation. (Mr. Ralph J. Cordiner, President, General Electric Corporation.) [3]

Ignoring for the present those arguments regarding the number of employees that have been or are destined to be displaced by the new machines, records and studies indicate the following trends in labor utilization: (1) the improved machines and equipment will reduce many of the present jobs which are boring, routine, and repetitious; (2) many workers can thus expect to be elevated to higher levels of attainment and self-development; (3) industry will accelerate their demand for workers capable of responsibility and versatility; and

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[1] Weinberg, "An Inquiry Into Automation," p. 4.

[2] Ibid.

[3] Ibid.

(4) the workers of the future will demand improved basic education and improved training to equip him for the rigorous demands of the emerging technical employment standards. [1]

Having concluded this section, it should now be clear that through the use of automated machines and equipment, it is now possible to produce the same volume or perhaps more goods with fewer labor inputs. It should also be recognized that the trend toward automation is rapidly accelerating both in range and depth and has already significantly affected America's key industries.

Automation and occupational skills

In this age of rapidly advancing automation, every blue-collar worker has two principle fears: will I lose my job, and if so, will I be able to find another? The only appropriate answer to both questions is: "it depends." It depends first on the skills that the worker possesses. It also depends on his ability to re-locate, to retrain, and to adjust to the effects of the technological revolution that is occurring.

As was noted earlier in this chapter, automated machines and equipment are replacing workers in a varied assortment of occupations and industries. Translating this fact into a meaningful omen for today's unskilled or semi-skilled laborer, it means he should be prepared to cope with the changing

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[1] Ibid., p. 5.

character of work. Manual work is rapidly being automated and production jobs constitute only about one-third of the American labor force, while the remaining two-thirds are in the fields of teaching, managing, selling, etc. [1]

The changing American labor picture is graphically represented in Figure 4. Figure 4 does not however provide the whole story; for while it is true that unemployment rates, or in this case jobs, have not suffered from a national point of view because of the opening white-collar jobs, the displaced unskilled worker has little chance of successfully moving into the white-collar field.

Economists, leaders of industry and labor officials have long been debating the argument over the job-creating aspects of automation. There are few who would debate the fact that technological advances have created millions of new jobs. Dr. W. Allen Wallis provides perhaps the best example of this optimistic viewpoint when he argues: ". . . just as the automobile generated far more jobs than the ones destroyed in the buggy industry, so will automation changes broaden total job opportunities. [2]

In analyzing Dr. Wallis's views however, one shortcoming is apparent: the matter of skills. The shifting

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[1]Lester Velie, "Where The Jobs Are," The Reader's Digest, January, 1965. (Reprinted by the Reader's Digest Association, Inc.)

[2]Darden Chambliss, "Economists Argue That Automation Creates Jobs," Tulsa Daily World, August 23, 1962.

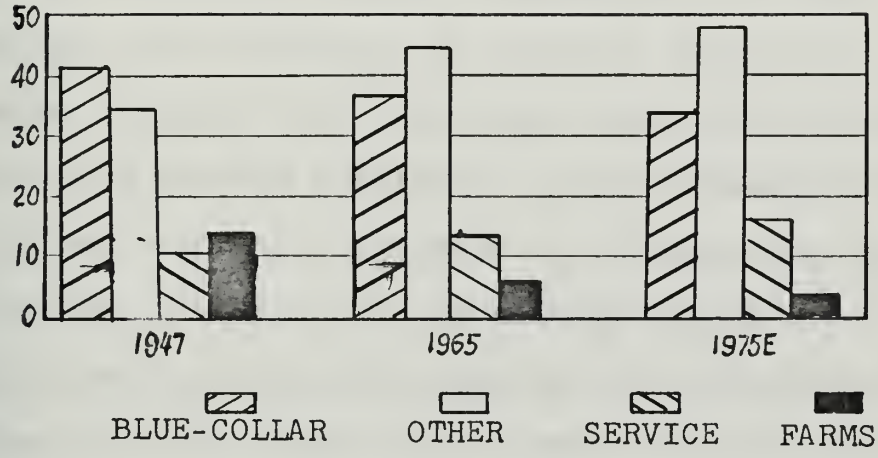

Fig. 4.--Decreasing proportion of blue-collar jobs (per cent of total employment). Source: Labor Looks at Automation, AFL-CIO Publication No. 21, 1966, p. 5.

of workers from one occupation or industry to another may be more applicable in policy statements than in actual practice. Examples of the difficulties of retraining encountered by workers and by employers conscientiously engaged in assisting displaced workers are recorded in volumes of studies and reports. A classic study in this subject was made by the Armour Co. in 1960. In this particular case only one hundred seventy of the four hundred thirty-three workers displaced by machines were interested in learning new skills. Of the one hundred seventy, only sixty were declared eligible for the retraining program available, and only twenty of the fifty-eight who eventually finished the program ever took jobs in fields relating to their retraining experience. [1] There are many other disappointing examples of attempts to provide workers with new skills and perhaps the problem can be simplified by stating that too many workers have neither the educational background nor the motivation sufficient to make such programs worthwhile. In summary, actual experience has proven that the displaced production worker seldom, if ever, becomes the machine console operator or programmer. Such experiences are in contrast to the expectations of Peter Drucker who assumes that: "todays semi-skilled operator becomes tomorrows highly trained maintenance man, ..." [2]

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[1]Snyder, Challenge of Automation, p. 9.

[2]Peter F. Drucker, The Practice of Management (New York: Harper & Row, 1954), p. 372.

In addition to the problem of the lack of skills, the American blue-collar worker has not proven himself to be as mobile as many authors have adjudged him to be. The commonly held notion that displaced workers in one area will simply migrate to another area which has a requirement for their talents has little historical foundation. It should not be surprising that the average worker is reluctant to re-locate. His reluctance to change surroundings is a normal human reaction based on both a fear of the unknown and a hesitancy to leave the familiar. As long as unemployment remains general, the re-location of surplus labor will be resisted by the businessmen in the community left behind objecting to the loss of business and will be resented by the new community's work force because of the increased competition. [1] In one of many such situations studied, the plant involved eliminated three hundred twenty-five jobs, and of these, two hundred and sixty-five persons were in debt over nine hundred dollars on the average and over one hundred were homeowners. As the sociologist who made the study remarked: "for those in debt and with homes of their own, moving was virtually an impossibility." [2] As could be expected, displaced workers usually find re-location most expensive, both in terms of money and social satisfaction.

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[1]Brookshire, "Automation," pp. 34-35.

[2]Snyder, Challenge of Automation, p. 10.

One final note should be made in discussing the shifting of displaced workers. It is that new jobs often prove costly in terms of lost seniority, lost retirement and other accrued benefits, as well as the fact that too often the new jobs pay less in wages than many of the well paying factory jobs that were automated. [1] In addition, it can be readily surmised that the heaviest burden of hardships created by technological unemployment falls on the geographically isolated, the older, the poorer, and the minority group workers. It should also be obvious that these same groups are the least likely to be able to help themselves in their struggle for economic survival.

Automation and Productivity

In the history of human industry, increases in productivity came in the form of the substitution of new energy sources for old, the improvements in worker skills, the extension of markets for products, or the availability of increased capital. To the above list must now be added the introduction of automation. [2]

Any treatise or discussion on productivity must, if it is to be of value, answer the basic question: why the trend toward automation? Walter Buckingham has aptly answered the question when he relates that an industry or company automates

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[1] Labor Looks at Automation (Washington, D.C.: AFL-CIO, Publication No. 21, 1966), p. 16.

[2] Automation's Unkept Promise (Washington, D.C.: AFL-CIO, Publication No. 47, 1962), p. 10.

because: (1) automated equipment is capable of performing tasks which would otherwise be impossible regardless of other factors involved; and (2) automated equipment reduces or eliminates labor costs with no sacrifice to production. [1]

The essence of productivity is the measure of output per given input and this given input may be expressed in terms of hours, labor dollars, capital investment, etc. Productivity in the United States has been rising at a tremendous rate regardless of the standard used and this increase is graphically displayed in Figure 5. While there is little doubt that technological advances are largely responsible for this vigorous growth, other factors have also had their impact. Thus, the National Association of Manufacturers points out:

> A frequently overlooked facet of productivity change is the economic policies of a country. These may exert a profound influence on the degree to which given resources are utilized. Thus, monetary and fiscal policy, the height of tariffs, the attitudes and practices of managements, and labor unions, the degree of competitiveness of markets, the "business climate"--all these may be good or bad, effective or ineffective, restrictive or liberating, but they are not technology or automation. [2]

The productivity aspects of automation have created an entire new field of economics. The decision whether to automate often requires a lengthy and complex study of situations in the present and those expected. Automated machines, including

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[1]Walter S. Buckingham, "The Human Side of Automation," in Readings in Human Relations, ed. by Keith Davis and William G. Scott (New York: McGraw-Hill Book Co., 1964), p. 396.

[2]Patrick M. Boarman, Facts and Fancies About Automation, NAM Industrial Relations Sourcebook Series (New York: The National Association of Manufacturers), p. 3.

INDUSTRY	OUTPUT PER PRODUCTION WORKER MAN-HOUR				
	1950	1955	1960	1965	1966
COAL MINING	61.6	87.7	114.9	152.9	161.7
COPPER MINING	84.3	90.0	103.6	119.6	119.7
IRON ORE MINING	93.6	111.3	104.7	127.8	127.8
ALUMINUM ROLLING	(N/A)	(N/A)	102.0	161.1	(N/A)
CANNING AND PRESERVING	76.1	90.0	108.5	128.6	(N/A)
CEMENT	67.5	92.1	105.7	146.8	(N/A)
PAPER AND PULP MILLS	78.4	90.4	109.5	140.3	(N/A)
PETROLEUM REFINING	68.3	87.8	115.9	166.5	(N/A)
STEEL	87.7	99.8	99.6	119.6	122.7
TIRES & INNER TUBES	82.7	86.2	111.5	154.8	(N/A)
PRIMARY ALUMINUM	69.3	82.2	121.3	141.6	(N/A)

Fig. 5.--Productivity indexes of output per man-hour--production workers, selected industries: 1950 to 1966 [1957-59 equals 100], (N/A Not available). Source: The U.S. Book of Facts, Statistics, & Information For 1969, p. 230.

the computer, are costly and the transition from old to new systems involves the added expense of highly skilled technicians, programmers, and maintenance personnel. Despite these initial high costs however, automated equipment properly planned and installed may be expected to substantially reduce labor as well as other costs. A Department of Labor study of an insurance company computer installation reports the following dramatic results: (1) office personnel were reduced from one hundred ninety-eight to eighty-five; (2) office floor space requirements were reduced 15,000 square feet; (3) key punch equipment rental was reduced $216,000. annually; and (4) punch card requirements were cut by nearly two and one-half million cards monthly. [1] Additional and more specific information on savings through automation is contained in earlier sections of this chapter.

Productivity and employment levels

Despite a lack of ability to measure the precise degree of impact that automation exerts on productivity, one can nonetheless conclude with absolute certainty that gains in productive efficiency as a result of technological improvements have one vitally important message for the American worker: fewer labor hours are needed to produce the same or even greater amounts of goods.

The fundamental economic principle expressed above is

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[1]Diebold, "Bringing Automation Up to Date," p. 29.

the key to previous discussions concerning the impact of automation on employment. The relationship between productivity and automation, as in the case of unemployment and automation, is best described by specific examples. The most dramatic example of the effects of technological change on productivity is found in the American agricultural industry. In 1800, nine farm workers were required to produce enough food and fiber for themselves and for one additional person. This means that at that time, only one out of every ten persons in the economy was available for non-agricultural production. The significance of such a ratio is that, had it not been for technological advances, 63,000,000 workers out of our 70,000,000 labor force would be tilling the soil today to feed and clothe the nation. [1] Literally millions of other examples could be cited wherein productivity has soared as a result of conventional man-machine methods being replaced by technological innovations. The Ford Motor Company, at the Cleveland plant previously cited, has reduced the time required to produce an engine block from a rough casting from twenty-four hours to fourteen and one-half minutes. In 1908, a skilled sheet metal worker labored eight hours to form the upper half of a fuel tank. Automatic stamping machines accomplish this same task in twenty seconds. The North American Aviation Company now

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[1]Robert L. Hershey, "What Kind of Growth Do We Want?" (printed text of an address presented at the dedication of Summerfield Hall, University of Kansas, Lawrence, Kansas, April 9, 1960), p. 6.

operates an automatic skin mill which can form a one piece wing assembly out of solid metal in three and one-half hours; the operation formerly required over sixty hours. [1]

In the utility industry similar astonishing results are being attained from push-button plants and equipment. One plant near Cleveland, Ohio produces 290,000 kilowatt-hours of electricity with their existing conventional facilities employing one hundred men. The company's new plant will employ only twenty-eight men and will produce over 420,000 kwh. Additionally, a pilot nuclear powered generating plant is being built near Pittsburgh and is expected to produce sufficient electricity for that entire city with only a staff of six men required. [2]

All of the examples cited above add up to one simple fact of modern living: work that was formerly done by people can and often will be performed quicker, cheaper, and better by new machines, instruments, and other devices. Thus, productivity increases mean displaced workers, lost wages, and economic suffering for those involved. It also means however, new demands for new skills with higher wages as well as an opportunity for better living because of price reductions resulting from cost savings through productivity increases.

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[1]Walter S. Buckingham, "Gains and Costs of Technological Change," in Adjusting To Technological Change, ed. by Gerald G. Somers, Edward L. Cushman, and Nat Wienberg (New York: Harper & Row Publishers, 1963), p. 15.

[2]Robert Bendiner, "The Age of the Thinking Robot, and What It Will Mean to Us," The Reporter, April 7, 1955, p. 14.

These latter aspects of productivity (i.e., earnings and prices) are the subject of the remainder of this section.

Productivity and earnings

Automation promotes higher wage levels for the blue-collar labor force in two ways: (1) automation creates a demand for workers with greater skills and these skills demand higher pay; and (2) by providing increased productivity through reduced costs, added profits are available to management to be divided amongst labor, management, consumers, and the stockholders of a corporation.

The first factor above is easily understood and accepted by anyone having even the slightest knowledge of economics. The second factor however has always been and continues to be a bitterly contested issue. Increases in productivity normally result in a greater differential between costs and selling price and thus increased revenues. The question then arises as to how these added revenues should be divided among the four parties concerned. The solution to this complex problem is beyond the scope of this paper, however it would appear economically sound and socially just that savings accruing from productivity gains of automation should be distributed equitably to those responsible: the workers for their contribution to increased output, the consumers for their increased consumption, the investors for supplying the additional capital, and the

management for their wise capital investment decisions. Under such a scheme, everyone would benefit and our economic growth would be sustained. It is equally true however, that when one party or another reaps all the benefits of increased productivity, unemployment and inflation invariably result. [1]

In actual practice, the benefits of productivity increases affect industries in two distinct ways. If the industry in question has a small direct labor content in each unit of production, technological innovations permit increased wages with little or no effect on costs. This is the case with America's steel industry. In the case of many small businesses however (e.g., shoe repairing) substantial amounts of direct labor in the finished product mean that wage increases will inevitably generate increased prices regardless of technological advances. [2]

One final note that seems appropriate at this point is the reported findings of a study of productivity and earnings which was conducted by the AFL-CIO in 1965. This study sought to establish relationships between productivity increases and employment, earnings, and job tenure within the

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[1]Ellison L. Hazard, "The Real Danger in Automation," (printed text of an address presented at the Executive Club, Chicago, Illinois, October 9, 1964), p. 8.

[2]Ted F. Silvey, "Automation-The Three-legged Stool," (printed text of an address presented at the ninth annual conference of the North American Council of Specialty Unions of the International Printing Pressmen and Assistants Union of North America, Cincinnati, Ohio, October 7, 1961), p. 8.

twelve basic industries. [1] This study concluded with the following findings:

> Changes in the rate of productivity growth are related to general economic conditions (i.e., the demand for goods and the competitive market situation).
> Industries with a high productivity growth tend to have a relatively high production worker earnings growth.
> Industries with a high productivity growth do not tend to have a relatively high employment growth--except possibly during a period of economic down-turn.
> Industries with a high productivity growth appear to afford relatively long job tenure.
> High productivity growth appears to increase production worker earnings more than it either increases or decreases employment, insofar as these can be compared in terms of their indexes. [2]

Productivity and prices

As noted earlier in this chapter, technological changes not only result in more goods but should result in cheaper goods by reducing the costs of production. The fact that prices have not fallen substantially cannot be attributed to a lack of productivity gains, but their failure to decrease is instead clouded in issues over increasing wage rates, inflation, and excess profits.

To evaluate the matter of providing the blue-collar labor force with real wage increases as a result of stable or decreasing commodity prices would involve a complex and lengthy

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[1]The twelve industries included: Transportation Equipment, Telephone Companies, Chemical and Allied Products, Textile, Machine (excluding electrical), Primary Metal, Lumber and Wood, Motor Vehicles and Parts, Instrument and Related Products, Electrical Machinery, Stone, Clay and Glass, and Banking.

[2]Report of the Diebold Group, Inc. on Automation--For the Communications Workers of America, AFL-CIO, (New York: The Diebold Group, Inc., 1965), p. 144.

economic survey and is beyond the intent as well as the ability of the author. It should suffice to state that: automation has provided vastly improved productivity; improved productivity means more output per the same unit of input; increased output per same unit of input means less costs; and lower costs can and should be passed on to consumers and others in the form of lower prices and real wage increases.

One striking example of the benefits of technology reducing prices may be found in the cellophane industry. In 1924, when cellophane was discovered, it sold for $2.65 a pound. By 1937, as a result of research in both the product and manufacturing methods, the price of this commodity was lowered to $.40 a pound. Since 1939, the prices of the raw materials required have risen over 118 per cent and the maker's wage costs have risen 227 per cent. Despite these rapidly spiraling production costs, price increases have been held to only 53 per cent and the price of cellophane today is approximately $.62 a pound. Had it not been for the technological developments, cellophane would now cost over $6.00 a pound. [1]

Automation and New Products

The one very bright spot in the relatively gloomy future of automation for the blue-collar labor force is the development of new products and processes. The new computers

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[1]Hershey, "What Kind of Growth?", p. 11.

with their increased capacity for storage and processing have made possible many new discoveries and have permitted the solutions to problems which have heretofore been beyond the abilities of man or machine. New processes and materials have been developed which often are superior in many respects to the natural products they were intended to replace.

Automation has also been a blessing to many workers who for years labored through an eight hour day operating an elevator or shuffling mail in the post office prior to cancellation of the stamp. The introduction of automatic elevators and automatic mail cancelling machines is replacing the former attendants. Hopefully these workers are now able to provide a more productive contribution to society.

Aside from the direct advantages which have resulted from the trend toward automation, the increased leisure time which workers now or soon will enjoy should require an increase in the number of people engaged in the travel industry, in entertainment, in recreational goods and facilities, in education, in cultural and voluntary social work, in the building and re-building of roads, and in numerous other beneficial activities. [1]

The American public can also look to a healthier future as a result of technological progress. The National Commission on Technology, Automation, and Economic Progress reported in

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[1]Bendiner, "Thinking Robot," p. 7.

1966 that substantial advances have been made during recent years in the development of new and advanced equipment for health technology. These advances include new laboratory and X-ray equipment for use in diagnosis, new operating room equipment, new instruments to improve post-operative care, and computers promoting more effective hospital administration. [1]

In addition to new products, John Diebold has even speculated on the inception of new industries. In a recent interview, Mr. Diebold predicted:

> One brand new industry is going to be what I'd call the 'inquiry industry.' It will make use of the computer's vast memory ability, its capability for storing and retrieving information. Today, the dollar value of this computer-based 'inquiry industry' is probably less than 20 million dollars. Our studies show it will exceed 2.5 billion dollars by 1975. [2]

Summary

The goals and objectives of this chapter were to describe and evaluate the economic effects of automation on the blue-collar labor force. Economic implications were distinguished from those of a social nature by the fact that the former are fundamentally financial in nature (i.e., economic effects result in changes to employment levels, wage levels, price levels, and consumption patterns).

Automation has exerted a pronounced influence on the

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[1] "Mobilize America's Resources to Cope With Automation," The Automation Report, (Reprinted from the Industrial Union Department Agenda, AFL-CIO, Washington, D.C.: AFL-CIO, February, 1966), p. 22.

[2] John Diebold, "What Comes Next in the Computer Age," U.S. News & World Report, June 26, 1967, p. 54.

national employment picture. The basic industries have been installing automated equipment at a very rapid pace and labor statistics indicate that approximately 40,000 jobs are being automated every week. The production workers are the single group most seriously affected by the automation trend. The decrease in demand for blue-collar workers, to a large extent, is being offset by an increased demand for white-collar workers in all industries: both product oriented and service oriented.

The introduction of highly complex and sophisticated machines and equipment have also created a severe "skill gap." While the debate over the extent of the job-creating aspects of automation continues, there are nonetheless hundreds of thousands of displaced production workers who do not possess the skills necessary to compete in the market for the new labor force.

Two common myths that are often heard in discussions on the unemployment aspects of automation are that the displaced American blue-collar worker need only retrain himself for better jobs and/or can freely move about the nation in search of re-employment. Research and experiments with both assumptions have proven conclusively that retraining is difficult, expensive, and generally futile; and the displaced worker is the one least likely to be in a financial position allowing him to transport himself and his family over the countryside seeking work.

It was also noted that displaced workers often are faced with economic hardship despite the fact that they find a new job because of their lost seniority and retirement benefits. Those hardest hit by technological unemployment are the geographically isolated, the older, the poorer, and the minority group workers.

The answer to the question "why do industries automate?", is found in the increased productivity that automation makes possible. By replacing human workers with machines, more output is achieved per given unit of input. Labor cost reductions are not the only benefit of automation. Space savings, improved quality of output, and other cost reductions have also been experienced by companies installing automated equipment.

Improved productivity is seen to be the key element in the problem of technological unemployment since machines are now available to perform most any human physical effort and often can perform them faster, cheaper, and more effectively. While promoting the displacement of workers however, productivity increases have also created new demands for higher skilled labor, provided the increased revenues permitting higher wages, and made possible the stabilization and, in some cases, reduction of prices for finished products.

The distribution of added revenues accruing to a company through improved productivity as a result of technological innovation is a highly controversial issue. It

appears however that the most equitable distribution of these added gross earnings would be one that provides all parties concerned (i.e., labor, management, owners, and consumers) with an appropriate share. Production workers not displaced by automation have generally benefited from the increased productivity by higher wages primarily and lower consumer prices secondarily. Increased wages and lower prices via automation is most promising in industries characterized by low direct labor inputs per unit of output (e.g., steel, petroleum and cement).

CHAPTER III

SOCIAL IMPLICATIONS OF AUTOMATION

An attempt to assess the sociological impact of automation and the rapidly accelerating technology can be a very risky undertaking. Unlike similar attempts to assess economic implications, few statistical studies are available which specifically relate social problems and progress to the well publicized gains in productivity and industrial research associated with automation.

While many noted authors and lecturers have attempted to describe the social potentialities of our trend toward automation, Walter Reuther has summarized it most succinctly when he testified before Congress:

> It [automation] opens up wide new possibilities for human and social betterment.
>
> A 5 per cent annual growth rate in our national product means that the total volume of all the goods and services we produce can be doubled in just over fourteen years. By 1975 we could have a total production of goods and services in the United States worth a trillion dollars--one thousand billion dollars--at today's prices. Taking population growth into account, this would make possible a personal income after taxes which would average almost three thousand dollars per year for every man, woman and child in America or twelve thousand dollars for an average family of four.
>
> It could mean the absolute elimination of poverty in our land.
>
> It could mean greatly improved standards of living, including increased leisure, for every family.
>
> It could mean rapid progress in providing the fullest educational opportunity to every child, based on adequate

> facilities and a sufficient number of well-trained and well-paid teachers.
>
> It could provide the means to make the best of health care available to all.
>
> It could mean the elimination of slums, the regeneration of depressed areas and the redevelopment of neglected areas in our cities.
>
> It could give us the means to provide effective assistance to other countries which need help in building up their economies--help which may make the difference between survival or failure of freedom in those lands.
>
> Automation and technological advance have put all these highly desirable goals within our reach. They have done something more. They have made it not merely desirable, but absolutely essential that we reach them. [1]

To provide the proper setting for the remainder of this chapter, it is considered beneficial to reflect for a moment on the changes in our daily lives which have occurred in the recent past. Perhaps the quickest approach to this exercise would be to review the pages of a thirty year old Sears Roebuck catalog. The 1939 catalog contains no long-play records, no dishwashers, no drip-dry clothes or fabrics, no tape recorders, no miniature riding lawn mowers and, most significantly, no T.V. sets. [2]

Sociologists have studied and examined the changes in society wrought by changes in technology from many different points of view. One such scientist, Daniel Bell, views the phenomenon in terms of the "changes of scale in our lives." Bell relates that:

> An individual today, on the job, in the school, in a neighborhood, in a profession or social milieu, knows

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[1]Reuther, "Automation and Energy Resources," pp. 274-275.

[2]Charles R. Walker, Technology, Industry, and Man--the Age of Automation (New York: McGraw-Hill Book Co., Inc., 1968), p. 2.

> immediately hundreds of persons, and if one considers the extraordinary mobility of our lives--geographical, occupational, and social--over a lifetime one comes to know, as acquaintances and friends, several thousand. And through the windows of the mass media--because of the enlargement of the political world and the multiplication of the dimensions of culture--the number of persons that one knows of accelerates at a steeply exponential rate. [1]

Regardless of the approach taken in the study of the social effects of automation on American society, all the opinions expressed may be categorized into two opposing views: the optimistic approach and the more pessimistic and pragmatic convictions. The former view is best exemplified by the following quotation:

> For the expanding, dynamic economy of America, the sky is indeed the limit. Now more than ever we must have confidence in America's capacity to grow. Guided by electronics, powered by atomic energy, geared to the smooth, effortless workings of automation, the magic carpet of our free economy heads for distant and undreamed of horizons. Just going along for the ride will be the biggest thrill on earth. [2]

Walter Reuther, in his role as a powerful labor leader, has taken exception to this "magic carpet" theory. As a representative of the more skeptical approach, Mr. Reuther has delivered the following retort:

> We do not believe that any thinking person is prepared to accept the NAM's 'magic carpet' theory of economics. Automation holds the promise of a future of new abundance, new leisure and new freedoms, but before that future can be achieved there will be many serious and difficult problems to be solved. We do not believe that the American people or the Congress are prepared to just go along for

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[1] Ibid., p. 3.

[2] National Association of Manufacturers, Calling All Jobs, p. 21.

the ride. [1]

From the citation above, it should be clear that automation poses a vast array of social implications (i.e., automation's social consequences have a much broader scope than its economic effects). It is then the intention of the author to present, in the remainder of this chapter, the major social effects of automation on the blue-collar worker. This broad subject will be covered in terms of two distinct social spheres: (1) the social effects of automation and technological change on the worker on the job, and (2) the consequences of progressive automation on the society to which the individual worker belongs.

Social Effects on the Worker

In order to fully evaluate the social effects of automation on the worker, it is first essential that the social aspects of work itself be appreciated. The importance and meaning of work in our society is fundamental. Work is the unescapable fate of the vast majority of Americans. It is a most important segment of adult life and its impact suggests that it would not be an overstatement to say that work is not part of life; it is literally life itself. Work is one of the principal sources of status in current society. The kind of work one does determines one's place in life. [2]

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[1] U.S., Congress, Subcommittee on Economic Stabilization of the Joint Committee on the Economic Report, Automation and Technological Change, Hearings, 84th Cong., 1st Sess., 1955, p. 102.

[2] Bernard Karsh, "The Meaning of Work in an Age of Automation," Current Economic Comment, August, 1957, pp. 3-4.

The importance of the above analysis of work results principally because the entire spectrum of kinds of occupations has been altered significantly by the rapid advance of automation. The changing skill scale of America's work force has been adequately described in general terms in chapter two and will not be repeated per se here. What will be presented however, will consist of a brief presentation of those characteristics or dimensions of work which have been most affected by the new technology. [1]

The individual's knowledge and skill requirements

As noted in chapter two the new machines require greater skills for operators, designers, and installation and maintenance personnel. The number of typically blue-collar occupations have been declining, while the number of professionals and those in the service industries have been steadily increasing. This trend means that job opportunities for those without higher education or other specialized training are becoming more and more scarce. For the young worker just entering the labor force, automation has an ominous message: the jobs in the basic industries of mining and manufacturing which formerly provided many opportunities for the unskilled are rapidly declining. At the same time however,

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[1]Charles R. Walker provides a more comprehensive description of these dimensions in his discussions of "human problems in mass-production technologies"; see: Technology, Industry, and Man, pp. 95-99.

the youth of today has many new employment opportunities in the white-collar field, but these openings are available only to those with qualifications beyond the average semi-skilled production worker.

The requirement for higher skills and training has created a coincidental requirement for more schools and teachers and other educational facilities. When these requirements are met, the individual as well as society at large has benefited. [1] The nature of this upgrading of skills and its significance is best described by Peter Drucker when he relates:

> Mass production upgraded the unskilled laborers of yesterday into the semi-skilled machine operator of today--and in the process multiplied both his productivity and his income. In just the same way, automation will upgrade the semi-skilled machine operator of today into a highly skilled and knowledgeable technician--multiplying his income again. [2]

It is also noteworthy that the continuing trend toward automation may well mean the end to many of the arts and crafts which formerly provided a respectable income and steady employment for thousands of artisans and craftsmen. Such skills as drafting, machine work, welding, and typesetting have, in many instances, been priced out of existence by the economies offered by automated processes.

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[1]Department of Research, Labor Economic Review Report, AFL-CIO, The Erosion of Jobs and Skills (Washington, D.C.: AFL-CIO, 1963), pp. 6-7.

[2]Peter F. Drucker, "The Promise of Automation," Harper's Magazine, April, 1955, p. 57.

The workers on-the-job conditions

Automation should make the average industrial workplace cleaner, safer, and more pleasant. [1] Studies in many automated manufacturing companies have indicated that hernias, eye injuries, and foot accidents have virtually been eliminated because of the installation of automated material handling equipment and mechanized hazardous production processes. [2]

Partially offsetting this reduction in physical risks however are the increasing emotional problems that have been noted among production workers in automated plants. Ulcers, heart disease, and other physical maladies traceable to emotional stress, are increasing among the computer occupations as well as the machinists who work in combination with them. Various interviews with workers, new to the automated factories, have conclusively shown that the new technology has replaced muscular fatigue with increased tension and strain. This new mental effort that is required of workers has taken many forms but one which describes the nature of the problem best is: "the compulsion to 'watch' all the time, to act on split-second notice, and never to make mistakes, because of the dire consequences to machine and product, and even to themselves." [3]

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[1]Ted F. Silvey, "Data Logging: Labor and Automation," (reprint of a paper presented to the Sixth Symposium and Instrument Fair, Philadelphia Section, Instrument Society of America, November, 1956), p. 5.

[2]Walter S. Buckingham, Automation (New York: Harper & Bros., 1961), pp. 93-94.

[3]Charles R. Walker, "Life in the Automatic Factory," Machines and the Man, ed. by Robert P. Weeks (New York: Appleton-Century-Crofts, Inc., 1961), p. 127.

One promising aspect of the working environment which the new machines may eventually promote is the pronounced departure from the philosophy of "scientific management." As George B. Baldwin and George P. Schultz suggest:

> Automation challenges the still prevalent management philosophy which states: '(1) Break the work process down into the smallest possible components, (2) fit jobs into a rigid structure that emphasizes the duties and the boundaries of the job rather than its part in the process, and (3) put everyone possible on an individual or small group incentive system, gearing pay to output on the particular job.' This philosophy inevitably has tended to identify the individual with an even more narrow task, giving him positive incentives to restrict his interests and no incentive at all to think beyond his immediate work environment . . . .
>
> Automation is likely to challenge these habits of thought fostered by discontinuous and highly specialized methods of production. . . . It requires a new way of thinking . . . that emphasizes continuous movement of work through a total process rather than a stop-and-go process, thought of as the sum of independent operations. [1]

It is possible though, under automated conditions, to construct jobs which are narrow in scope and capable of producing boredom through, for example, simple repetitive operations. The statement of Baldwin and Schultz should be viewed in terms of opportunities for improving work under automated conditions, rather than absolute guarantees for such. The design of jobs thus remains a critical management problem.

A final note on the subject of worker tensions is provided by Professor Faunce. His studies of the mental activities of workers as stimulated by the new machines have

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[1] Industrial Relations Research Association. Proceedings of the Seventh Annual Meeting (Detroit, Mich., 1954), pp. 124-125.

caused him to remark:

> . . . nervous tensions are . . . higher after automation but, significantly, 72 per cent [of workers studied] preferred their new jobs in automated departments over their previous factory work. [1]

Automation and workers' interactions

Earlier in this chapter it was pointed out that the basic changes in industrial technology mean changes in both division of labor and job content. As task elements and jobs are being eliminated and combined, the workers assigned duties are widened and enlarged. These job structure changes have affected the social interactions of the workers in various ways. For one example, the group effort which was so prominent among former production teams has been replaced by a series of integrated systems. The result of this transition to mechanization has been the destruction of old friendships and associations and the loss of social anchorages.

Innovations in production worker job structures and the ensuing breakdown in social patterns has also occurred because automation has tended to modify labor union membership in some industries and has increased management control over the social interrelations of workers. This tenet was recognized by Bernard Karsh when he stated:

> Trade union solidarity is fostered, at least in part, by the intimate relationships between workers thrown closely together in the workplace and by the development among them

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[1]Buckingham, Automation, p. 96.

> of common perceptions of their divorcement from management. With fewer workers in a given plant, and with these workers spatially isolated from each other, the corporation can exercise far greater social control over its workers. The works manager, presumably, can know all the men personally, and the spatial and social integration of workers in a non-automated factory may be replaced by a spatial and social integration of workers with supervisors. Under these conditions, a new kind of trade union identification may occur . . . . [1]

One final note that is considered pertinent is the fact that, just as advancing technology is expected to affect the behavior and attitudes of managers regarding organizational loyalty [2] and individualism, [3] there is no apparent reason to believe that the "new" production worker will not be similarly affected. It is perfectly logical to assume that even the blue-collared specialists in automated factories will demand more control over their jobs and will pressure for more job enlargement as a result of their greater educational achievements. It is equally apparent that personal needs and aspirations may have to be satisfied largely outside of the plant because of the increased requirements of the new jobs.

Automation and work alienation

This dimension of the study of automation and the blue-collar work force is perhaps the most important of all and is

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[1]Karsh, "The Meaning of Work," p. 11.

[2]Thomas L. Whisler, "The Manager and the Computer," The Journal of Accountancy, (January, 1965), p. 8.

[3]Harold J. Leavitt and Thomas L. Whisler, "Management in the 1980's," Harvard Business Review, XXXVI (November-December, 1958), pp. 44-45.

interrelated with every factor discussed thus far in this paper.

That worker satisfaction is of concern to most managers, to union leaders, and to workers themselves needs no further verification. Worker alienation under typical assembly line production has been the subject of many studies and several common causes have been identified:

1. The almost complete lack of autonomy in determining work methods and pace.
2. The lack of a clear identification with particular jobs or products because of severe division of labor practices.
3. The anonymous environment of the large factories.
4. The characteristic of low status occupations which permit, for the most part, contact only with machines or with others of equal status.
5. The general lack of opportunity for advancement to higher occupational levels. [1]

Automation appears to reduce or perhaps eliminate the causes enumerated above. Each of these factors was discussed directly or implicitly in earlier portions of this paper, but because of the importance attached to this matter, they will again be taken up.

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[1]Charles R. Walker, Technology, Industry and Man, pp. 95-102; William A. Faunce, Problems of an Industrial Society, McGraw-Hill Social Problems Series, (New York: McGraw-Hill Book Co., Inc., 1968), p. 121.

Automation will introduce new requirements for judgement and knowledge which will replace prior feelings of total worker dependence on the production process. The monotony and repetitiveness of former manual or semi-automatic production processes will give way to new challenges for workers who are repair men and technicians and not slaves to a machine which directs and paces each motion and moment of their working day. [1] The exact extent of worker autonomy afforded by the new machines has not of course been measured exactly. According to a Davis and Werling survey however, fifty per cent of those chemical workers interviewed responded that they are usually able to plan their work; thirty-four per cent stated they frequently are able to plan, and only six per cent replied they are seldom or never able to plan their jobs. [2]

The new technology which required workers to learn more than their own job will mean that workers will begin to focus on the big picture (i.e., the whole interrelated process which ultimately turns out a finished product). This fact will eliminate the emphasis on the individual contribution and will highlight the entire process in terms of costs and output and in terms of the factory as the unit of production. [3] It may also be expected that workers will have a greater opportunity

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[1]For a more comprehensive treatment of worker monotony see: Walker, Technology and Man, p. 161 and Walker, "Life in the Automatic Factory," p. 128.

[2]Walker, Technology and Man, p. 161.

[3]Karsh, "Meaning of Work," pp. 12-13.

to relate to products because of the increased pressure to avoid errors and omissions which would prove extra costly under the fast and high volume new production techniques.

The automated factories of today and tomorrow are and will be, quite different from those of yesteryear. New plants are cleaner, safer, and provide a vastly improved environment for improved worker morale. In addition to the improvements in environmental safety and hygiene, new plant designs may also affect the social patterns of the workers involved. In contrast to the findings of Karsh which were described earlier, Mann and Hoffman have reported in studies of a newly constructed, fully automated plant:

> The centralization of the control systems into one floor in the new plant has brought the greater part of the operating personnel together . . . the design of the new plant has virtually eliminated the physical isolation of some of the jobs in the older system . . . this change in location of jobs gives the men more contact with each other, more chance to talk with others on the job. Although no direct measures are available on this, there is strong indication that the men feel a greater unity, more like a single group than they did previously. [1]

There are of course other automated production facilities which have not eliminated the social isolation of the traditional assembly line work. By increasing distance between work stations and by the increased attention required by the job, automation may in fact, initially promote worker loneliness. [2] The eventual result expected however, is the advancement of the

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[1]Walker, Technology and Man, p. 143.

[2]Faunce, Problems of an Industrial Society, p. 77.

"factory team" concept. As Charles Walker asserts:

> As industry becomes more automatic, I believe the tendency will grow to recognize the cooperative and interrelated character of every man's contribution to production, rather than meticulously to isolate and pay for segments of individual efforts. In fact, as the trend toward automatic machinery advances, I wonder if the distinction between direct or productive labor and indirect or non-productive labor does not tend to lose its old significance. [1]

Throughout this paper it has been asserted again and again that automation will demand increased skills and greater technical knowledge from production workers. The precise impact of this demand and its response from the blue-collar labor force has not yet been assessed because of the newness of the problem and lack of studies in the area. [2] It is considered a valid proposition however, that many new opportunities are becoming available for today's blue-collar workers. The successful and advancing worker will achieve success however, only be taking maximum advantage of educational and technical training programs.

Social Implications for Society

The effects of automation and technological changes on production workers in their non-work sociological environments are very broad and extensive. Perhaps the most concise yet comprehensive treatment of the effects in question is provided by a recent public report:

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[1]Walker, "Life in the Automatic Factory," p. 128.

[2]Walker, Technology and Man, p. 166.

> The fruits of our technology and our increasing productivity can be distributed in differing proportions in three ways: they can directly aid the individual by increasing his income, shortening his hours, or improving his worklife; they can be used for communal and social needs to improve his environment, health, and education of the people; and a portion can be used to aid other peoples. [1]

The quotation above implies or tends to emphasize only the positive side of the benefits of the new technology and hence the following note of caution, offered by John Diebold, is presented:

> I do not believe that we are presently experiencing the full economic and social influence of automation--that is, of fully utilized automation concepts and techniques. The acceptance of automation techniques by industry has been more gradual than it might have been. Technical or economic feasibility did not hold back the introduction of automation; lack of understanding the new technology, fear, improper planning and other human mistakes are more likely reasons. I think it would not be too great an exaggeration to say that the economic and social environment had a greater limiting impact on automation than the impact of automation on the environment. [2]

The interrelationship of the new technology and society can be approached from either the positive or negative view but regardless of approach, its significance cannot be dismissed. The all encompassing effects are stated very clearly by Arthur Kuriloff when he observes:

> There is little doubt that we are being swept by technological change into an era that many identify as the second industrial revolution. The new technology is changing our society, the industrial organization, and some aspects of the practice of management. There are

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[1] National Commission on Technology, Automation, and Economic Progress, Report of the Commission, Technology and the American Economy (Washington, D.C.: Government Printing Office, 1966), p. 74.

[2] Diebold, "Bringing Automation Up to Date," p. 48.

> some who believe that . . . there will be decreasing needs for management based on human factors in organization. Others believe that the significance of human factors will become vital to the survival of society as technology widens the gap between people and their physical worlds. [1]

In addition to writers who expound on the virtues or evils created by automation for society, there are also those, including social scientists, who ignore the social consequences and concentrate on the efficiency aspects of the computerized production processes. Of these latter authors and of their dubious contributions, Robert Boguslaw writes:

> And so it is that the new utopians retain their aloofness from human and social problems presented by the fact or threat of machine systems and automation. They are concerned with neither souls nor stomachs. People problems are left to the after-the-fact efforts of social scientists. And there is, of course, no dearth of effort addressed by social scientists to the problems presented by the fact of automation. The significant feature of virtually all this effort is that its most venturesome probes begin with an unquestioning acceptance of the technological status quo. The very real danger that arises is the salient one that contemporary and future generations will be wagged by their technological tails. [2]

As one can surmise from the above, there are both humanizing and de-humanizing effects of the new technology. Those who emphasize the negative view usually talk in terms of automation: (1) making the production worker a slave to a machine, (2) creating or at least promoting urban crises, (3) resulting in communities characterized by massive unemployment and (4) generating a present and future society

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[1]Arthur H. Kuriloff, Reality in Management (New York: McGraw-Hill Book Co., Inc., 1966), p. 223.

[2]Robert Boguslaw, The New Utopians: A Study of System Design and Social Change (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1965), pp. 3-4.

marked by human poverty and misery as a combined effect of the other three factors.

While this author does not dispute that automation may have effects which the prophets of doom are predicting, convincing proof exists which dispels any notion of a sine qua non cause and effect relationship. The blessings and evils associated with automation are within man's control and it is essential that the control is exercised in a timely and appropriate manner.

As an example of the control that is available, and one unfortunately that is being used to stifle the nation's economic growth, one can consider the case of the steel industry. Silvey argues that this industry, which has pioneered in automated factories and mechanization, has failed to take full advantage of the productivity which its new equipment offers. It has instead restricted its production to a reported fifty per cent of capacity so as to create an artificial price structure and has taken this action despite a growing need for this basic commodity. [1] This action has also resulted in lost wages and consequently lost buying power for workers who were laid off as a result of this decision.

In addition to the sweeping changes occurring in our society as a result of increased productivity and the

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[1]Ted F. Silvey, "Implications of Automation," (reprint of an address presented at the Brotherhood of Locomotive Firemen and Enginemen-Brotherhood of Railroad Trainmen Education Conference, Mancton, New Jersey, February, 1962), p. 2.

introduction of new products, industries, and employment opportunities, the rapid shift in the distribution of the labor force among occupations and industries is also a factor that may affect the institutional structure of society. With all of these changes evolving from the rapidly accelerating technological advances, revolutionary changes in social structure are inevitable. In view of these sweeping changes, the advice of Professor Faunce appears most appropriate and deserving of attention:

> The best strategy in all contemporary industrial societies, in view of their history of accelerating technological change and the current effort to stimulate new developments in production techniques, would appear to be to assume that the age of automation will come sooner than we think and to try to anticipate the problems that may be created by its arrival. [1]

Despite the interesting questions arising out of cases and theories presented above, it is intended that the remainder of this section be devoted to discussing the positive aspects of the automation trend. It is with this goal in mind that such topics as improved living standards, additional leisure time, and fulfillment of society's needs will be reviewed in terms of their potentialities as benefits of the new technology. It is to be noted that the most significant negative effects of automation were covered in the discussions contained in chapter two.

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[1]Faunce, Problems of an Industrial Society, p. 61.

Automation and improved living standards

American society enjoys the highest standard of living in the world. The tremendous quantities of consumer products which are available to most citizens of the U.S. are testimonials to American industrial productivity. By steadily increasing the output per man-hour, this society has supported greater numbers of people at ever increasing standards of living. These rising productivity rates have allowed the individual's real purchasing power to increase so tremendously that over the past fifty years the price of a dozen eggs or a dress shirt has decreased over eighty-five per cent. [1]

In addition to the productivity benefits of automation affecting consumer goods, the new technology is constantly opening new horizons in the areas of health, space, communication, transportation and recreation.

This improvement in living standards is best summarized and described in terms of economic consequences since, without the financial resources to procure the new products and opportunities made available by automation, their availability is simply a matter of waste. Thus, the following summary of benefits stemming from the new technology is presented:

1. An abundance of goods and services that is increasing in quantity, quality, variety, and availability.
2. A pronounced change in the distribution of the labor force from employment in the production of goods

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[1] Report of the Diebold Group, Inc., pp. 33-34.

to employment in the provision of services that is resulting in added earnings for both sectors.

3. A shift in the relative proportions of spending is occurring from expenditures on durable and non-durable goods to expenditures on the procurement of services.
4. An expanded market is developing for smaller enterprises which can and will provide the individualized goods and services that the changing society may demand at prices made inexpensive through automated procedures. [1]

Automation and leisure time

One of the biggest revolutions that is taking place in American society and culture is that caused by the newly found leisure time. Organized labor has rallied around the "increased productivity" banner and won many reduced work week concessions from management.

For a description of the success which labor has enjoyed, witness the following statement:

> The reduction of hours under collective bargaining in the 1960s is not taking place dramatically and suddenly. Rather the reductions are taking place in small steps in individual contracts. Gradually and steadily, these improvements are increasing the number of non-farm wage and salary workers on work schedules of less than 40 hours a week. These workers number 8 millon at present or 15 per cent of all wage and salary employees. Some of these 8 million workers won the 35-hour week 30 years ago; others won it just yesterday.

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[1] Ibid., p. 133.

> Shorter hours are not limited to any one segment of the American economy. Unions are winning shorter workweeks in construction, manufacturing, retail and wholesale trade, finance, insurance and real estate, the service industries, and in state and local governments.
>
> Several manufacturing industries are leading the way. Today, 98 percent of the printing trades workers are on standard workweeks of less than 40 hours; likewise 97 percent of the Ladies' Garment Workers, 65 percent of Brewery Workers, 15 percent of Rubber Workers, 13 percent of construction workers and 12 percent of retail workers. Among office employes, one-third are on schedules shorter than 40 hours. [1]

The working man of today, by producing over six times as much as his grandfather for every hour on the job, can now look to the four day work week that has been predicted by both Walter Reuther and Richard Nixon. [2]

Many new industries and employment opportunities are originating from this tremendous growth of leisure time. The question of how Americans are spending this free time is answered by Walter Buckingham when he states:

> Today one out of every six dollars of disposable income goes for leisure. Golf has become a middle-class sport. Over half of motor-boat sales are to skilled factory and office workers and salesmen. Sales of fishing equipment have doubled in a decade. While some spectator sports such as baseball and boxing have declined, participation sports like bowling and skiing have exploded with activity. Traveling abroad has quadrupled in a decade. Domestic travel has given birth to many new industries like motels of which over six thousand were built in the last two years. Winthrop Rockefeller predicts that by 2000 A.D. we will need forty times as much national park acreage as today. [3]

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[1]Department of Research, Collective Bargaining Report, AFL-CIO, The Shorter Workweek Trend (Washington, D.C.: AFL-CIO, 1964), p. 1.

[2]Buckingham, Automation, pp. 168-169.

[3]Ibid., p. 169.

While the quest for additional leisure time is indeed an endearing goal for most everyone, the reduction in working hours also raises some very important issues. First among these issues is the question of whether leisure is a force for good or evil. This issue is really a moral question that arises from what Alice Hilton calls the "Protestant Ethic." The concept of the "Protestant Ethic" is the belief that "hard work is next to Godliness." Its application and relation to today's leisure problem is best described by Miss Hilton when she states:

> It [Protestant Ethic] is a good ethos where virgin forests must be cleared, and wagon trains sent across a continent. It is a good ethos as long as men must wrest their meager fare from the earth with courage and fortitude and perseverance. In such a society, it is right that man should labor to plow the fields so that he might eat the fruits of the earth and bask in the sunshine of the heavens and dream under the shade of the trees.
>
> Already the ethos of scarcity is becoming an unjust burden. All too often thrift is no longer a god but the graven image of past days to which we give lip service. To save one's earnings and thriftily mend last year's coat, and use last year's car, and warm up last night's supper no longer is admired. But--the ethos that commands man to eat his bread in the sweat of his face still governs our personal lives and our national policies. Although for millions of human beings there is no place where they can put sweat on their faces, we still believe that there can never be another ethos for the future than the obsolete ethos of the past. And every year we are condemning more than two million human beings to the swelling ranks of the unwanted. We suspect them of incompetence and laziness, or we pity them. We should re-examine the ethos that condemns millions who are simply the first contingent of citizens living under cybercultural conditions without any preparation for the new age.[1]

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[1]American Federation of Information Processing Societies. Proceedings of the Spring Joint Computer Conference (Washington, D.C., 1964), pp. 142-143.

The important message in the citation above is that leisure is a blessing and the opportunity to rest and relax is a benefit of the new technology which must be anticipated and understood. Miss Hilton also points out the fact that there is an important distinction between technological unemployment and sloth. Thus, it is apparent that the time has come to revise the traditional view of leisure as a species of idleness and sin. [1]

A second question raised in discussions surrounding the new leisure is the matter of how the new leisure time should be spent. Because it is surmised that the blue-collar labor force of tomorrow will make up the new leisure class it is theorized that automation may be creating an absolute and radical change in our society. In earlier times, it was the aristocracy that enjoyed leisure while the masses worked almost ceaselessly. [2] In the world of today and tomorrow, the reverse will be true and the results of this transition may be frightening: more drinking, crowded highways, general mischief and an even more shallow society whose major media of entertainment is the television set. [3]

The above gloomy prospects of the uses for the new leisure time are challenged by David Sarnoff who offers these

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[1]David Sarnoff, "The Social Impact of Computers," (reprint of an address presented at the National Automation Conference of the American Bankers Association, New York, July 16, 1964), p. 4.

[2]Buckingham, Automation, p. 175.

[3]Ibid., pp. 175-176.

encouraging words:

> We will, of course, pursue the hobbies and interests that we have never before had sufficient time to undertake. For many people this will provide new possibilities for cultural and mental growth, deepened esthetic appreciations and enlarged intellectual activities.
> . . . the new approach will increasingly remove the ingrained notion that leisure means 'time to kill.' In its place will gradually come the custom, even the social compulsion, to spend the bonus of time for living on projects of personal and social benefit. [1]

And so the paradox of leisure continues unanswered, yet the task that remains for society is clearly in evidence:

> . . . how to stimulate the interests and change the attitudes of a large population that is forced to work shorter hours but is used to equating work and security, that will be bombarded with an advertising geist praising consumption and glamorous leisure, that will be bounded closely on one side by the unemployed and on the other by a relatively well-to-do community to which it cannot hope to aspire. Boredom may drive these people to seek new leisure-time activities if they are provided and do not cost much. But boredom combined with other factors may also make for frustration and aggression and all the social and political problems these qualities imply. [2]

Automation and the fulfillment of society's needs

The first order of business in determining the impact of automation and the changing technology upon the fulfillment of society's needs would appear to be the compilation of a listing of all of the unfulfilled desires of its citizens. Such an accumulation would of course be a monumental task and most certainly beyond the scope of this paper. As an

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[1] Sarnoff, "Computers," p. 4.

[2] Donald N. Michael, Cybernation: The Silent Conquest, Report to the Center for the Study of Democratic Institutions, January, 1962, (Santa Barbara, California: Center for the Study of Democratic Institutions, 1962), p. 33.

alternative, it appears expedient that the discussion be limited to generalities and restricted to the subject matter as contained in earlier sections of this work.

In this author's opinion, no better treatment of this most serious subject could be offered than to review the Congressional testimony of Walter Reuther which was presented in the beginning of this chapter. It is therefore intended that the following will both reply to the question of how automation can assist in the satisfaction of society's needs and also serve as a summary to this chapter.

Automation and the new technology opens up wide new possibilities for human and social betterment by increasing production and productivity. Such increases can serve to fulfill to a large extent many of man's current unlimited demand for goods and services. In consonance with this satisfaction of human desires greater production and productivity likewise provides greater earning power for the worker. In addition to increasing existing goods and services, automation holds great promise of introducing new products, occupations, and industries; all of which will increase national income figures substantially. Automation likewise enables American producers to compete more effectively on the world market and thereby open up vast new markets for U.S. goods and services and consequently provide more jobs for the nation's wage earners. Finally, productivity increases may provide the

resources to build new schools, hospitals, libraries, cultural centers, and other edifices beneficial to society.

Automation and the new technology will require a new breed of production worker. These new blue-collar workers will be better trained; they will work under better conditions; and most importantly, they will earn higher wages. This changing labor picture will also tend to encourage younger workers to better themselves through educational opportunities because the consequences of their failure to do so will be most obvious. A second and very important result of the reductions in production labor will be the potential influx of men and women into sorely needed occupations such as education, medicine, social work and public service.

Automation and the new technology also are providing workers with increased leisure time. This time can and hopefully will be spent in activities beneficial to both the individual and society. This newly acquired leisure has created new travel and recreational industries which have provided an enormous number of job opportunities while enriching the minds and bodies of the participants.

Finally, automation and the new technology is now providing, and will continue to provide in ever increasing volume, data concerning the workers' physical environment. This new knowledge about the universe will serve to promote a better life by increasing food and water supplies, conserving natural

resources including wildlife, assisting in man's control over the elements, and collaborating in the war against crime, disease, and natural disaster.

Perhaps the most fitting conclusion to this section and to this chapter as well, are the well chosen words of Normond Cousins who wrote:

> There is now scientific knowledge and experience which could within a short time be made to feed every human being on earth and supply the raw energy needed to work his machines . . . . An age of plenty for the living is now technologically possible and feasible. The only thing lacking to bring it about is wisdom. [1]

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[1]Silvey, "Data Logging," p. 3.

CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

This paper and the extensive research that accompanied its writing has proven beyond a shadow of a doubt that automation and technological change have had and will continue to have a profound impact on the blue-collar worker, both in terms of his mode of earning a living and of his life in society. As a matter of fact, it can be safely concluded that automation has introduced a new industrial age, the full impact of which can be neither predicted nor appreciated. With the introduction of some of the new devices and processes which man has developed, his economic and social environment has been affected to a considerable degree and these changes are the core of the conclusions that follow:

Major Manpower Trends

1. Because of the expected long term productivity increases, the employment of blue-collar workers in automated industries will continue to decline at an even faster pace than is currently being experienced.
2. Because of the promises of increased profit through rising productivity, many more industries and organizations will automate their facilities which

in turn will magnify the impact of the preceeding conclusion.

3. Blue-collar employment opportunities will continue to shrink over all and will be particularly affected in certain areas and specific industries. In addition to displacement by labor saving machinery, the blue-collar worker will be subjected to employment fluctuations caused by changing economic conditions, varying demand and costs, the impact of foreign trade, etc.
4. The unemployment impact of automation will be offset to a large extent, or perhaps eliminated entirely, by an expansion of output, a steady growth in the service-type industries, and a continued increase in the demand for white-collar workers.
5. The shifting pattern of labor from production work to white-collar jobs requires new skills and training, and unskilled or semi-skilled workers will have the difficult task of securing and maintaining employment in the new industrial era that is emerging.
6. With continuing productivity increases, wages may be expected to rise and give growth to unprecedented demand for goods and services generating additional employment opportunities.
7. Productivity increases through automation have also

made possible reductions in hours of work for many production workers. This trend is expected to intensify and expand to other workers. This additional leisure time will create new industries and occupations and contribute to the employment of displaced labor.

Major Sociological Trends

1. In the new automated plants of today and tomorrow, working conditions will be cleaner, safer, and more pleasant. The requirements of the new machines demand a constant alertness from the operators and have introduced new strains and tensions which the operators will have to adjust to or seek lower paying jobs with fewer opportunities for advancement.
2. Closely related to the conclusion immediately above is the finding that workers in automated plants may be faced with the loss of social interaction with fellow workers. This factor combined with the one above requires that supervisors now be better equipped to recognize and resolve potential social and emotional problems stemming from automation.
3. Automation has a tremendous potentiality for improving mans' physical, social, and cultural environment. Through productivity gains, more men are available for other more beneficial work; through

the development of new products and processes, new ideas originate; through the forced improvement in worker skills and training necessitated by automation, America's population as a whole is educationally upgraded. All of these factors serve to provide society with means to satisfy some of its greatest social needs. The American people need more schools and better qualified instructors, more and better equipped hospitals and clinics, cleaner and purer air and water, more and better housing, more recreational areas and facilities, additional and less expensive public health and utility services, and finally, more effective and efficient transportation facilities.

4. In the satisfaction of the social needs enumerated above, automation is also promoting the attainment of full employment, greater private enterprise investment and earnings, and most importantly, an unprecedented abundance which can be shared by all of the nation's citizens.

In view of the conclusions reached above, the need for certain recommendations relating to them becomes apparent. In the formulation of these recommendations, the responsibilities of labor, management, and the public sector, acting independently and in association with one another, must be considered. This

fact was well recognized by the former Secretary of Labor, Arthur J. Goldberg, when he wrote:

> The study of automation, a boon to some and a bogey-man to others, brings one eventually to an essential element in American life: the public responsibility that resides within private decision in a free economy. It points up for the businessman the fact that the conduct of his business influences not only the lives and welfare of his employes, but the national welfare. It reminds labor leaders that constructive and creative planning must replace opposition based on short-term considerations. And it brings home to the public the realization that the cost of freedom in economic life is responsibility.
>
> Enlightened businessmen, farsighted labor leaders and a responsible public can, together, make automation a general blessing. The policies and programs that will be emerging from industrial and national committees should be carefully watched by all Americans. They could well be the blueprint for a better world. [1]

Thus, the author will conclude this effort with the following recommendations addressed to labor, management, and government.

Recommendations to Labor

1. Organized labor should continue to support the automation and technological change trend by cooperating fully with management in the development of new products and processes which can then be enjoyed by all of society.
2. Labor should spend additional resources in the study of the effects of automation so as to provide appropriate rationale and policies for future collective bargaining and labor negotiations.

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[1]Arthur J. Goldberg, "The Challenge of Industrial Revolution II," in Automation--Implications for the Future, ed. by Morris Philipson (New York: Random House, Inc., 1962), p. 3.

3. Labor should also contribute a greater share of its vast resources of talent and money to the education and retraining of those members of the labor force who are expected to be displaced by the expanding automation trend.
4. The entire union movement should review its policies and regulations concerning wage rates, work weeks, promotions, and labor classifications to ensure that they are consistent with sound economic principles and compatible with the current state of the art of industrial technology.
5. Finally, labor should participate fully in conjunction with management and government in the sponsorship of study groups, commissions, and research efforts designed to identify and assess the past, present, and future effects of technological change; to evaluate the impacts of the changes in terms of jobs and industries; to determine the needs of the individual and of society in general which have originated in the emerging new technology; to recommend methods for channeling the benefits of automation into directions which promote optimal distribution to the population; and to develop and implement programs which define the responsibilities of labor, industry, and government.

Recommendations to Management

1. The professional managers of corporations should cooperate with organized labor to provide greater worker security and to ensure that labor shares equitably in the productivity increases accruing through automation. These measures taken up in collective bargaining negotiations would include stronger seniority provisions, shorter work weeks, severance payments, retirement rights, and investigations of new systems of compensation commensurate with the new techniques of industrial production.
2. Management must be prepared to accept as a moral obligation the responsibility to provide workers with as much advance notification of automation plans as is possible and must also be willing to share in the expenses of worker retraining, re-location, and severance.
3. Management likewise should endeavor to see that the benefits made possible by automation are made available to all (i.e., lower prices to consumers, higher dividends to owners, higher wages to labor, and better products for all citizens).
4. Finally, managers must come to the realization that their future and the future of the organizations they serve is, to a great extent, dependent upon the

social and economic conditions which exist in society. Thus, the manner in which the new technology is effected will ultimately decide their own fate. It is for this reason that plans for automation must be carefully and scrupulously formulated and executed and the total impact, social as well as economic, must receive maximum attention.

Recommendations to Government

1. Government should continue to expand the emphasis on education and training by the passage and effective execution of legislation similar to the Economic Opportunity Act of 1964 which provides for various training and assistance programs designed to aid youth, the aged, low income families, and poverty stricken rural areas.
2. Government must continue its efforts to promote a stable but growing economy which provides an economic climate conducive to job creation and job retention. Such measures will also provide for many of the nation's social needs (hospitals, schools, housing, etc.).
3. Federal, state, and local agencies should review their unemployment relief and social security programs to ensure their effective and efficient operation.

4. The Federal Government should maintain constant vigilance in opposing the use of the benefits of automation for purposes of consumer exploitation and monopoly formation. The full use of the commerce powers assumed by the Congress should be called upon when necessary to discourage and eliminate such abuses of productivity gains as was common to the coal industry several decades ago and is currently being exercised by the steel industry.
5. Finally, government must re-examine its entire range of laws, policies, and programs to ensure that their intended purposes and operation are consistent with the new society that is developing; a new society that is so vitally affected by the social and economic implications of automation and technological change.

Perhaps the most important lesson that has emerged from this entire effort is that this nation, so blessed with natural, human, and technical resources, has paced down the road of automation and technological change so quickly, that it has failed to recall its destination and the consequences of such a rapid rate. It thus seems appropriate that the words of Abraham Lincoln be recalled as a fitting conclusion to this paper: "If we could first know where we are and whither we are tending, we could better judge what to do and how to do it."

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